

so that the accompanying figures are to some extent diagrammatic. There appears to be a complete cartilaginous cranium, which is rather broad and somewhat depressed. The membrane-bones—parietals, frontals, mesethmoid, vomer, and parasphenoid—are thin. The cartilage-bones—basioccipital, supraoccipital, exoccipitals, epiotics, pterotics, sphenotics, prootics, alisphenoids, and lateral ethmoids—are for the most part separated from each other by cartilage. The slender palatine is attached to the anterior end of the vomer; the pterygoids, quadrate, etc., have no feature of special interest; the opercular bones are very thin, almost membranous.

The post-temporal is simple, attached to the epiotic; its lower fork is represented by a ligament. The coracoid ossifications are widely separated by cartilage, on which the four rather large radials are inserted. The small separate pelvic bones are remote from the pectoral arch.

The basalia of the dorsal and anal fins are not connected with the neural and hæmal spines.

The vertebral column comprises 70 vertebræ; the ribs are feeble and sessile; the hypurals have a radiating arrangement.

The exact systematic position of the *Icosteidae* is uncertain, but the great development of cartilage and the weakness of the bones is evidently secondary, and there is nothing in their organization to prevent the assumption that the *Icosteidae* represent a specialized and somewhat degenerate development of the *Perciform* type.

LXIX.—*The Classification of the Stomiatoïd Fishes.*

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THE Stomiatoïds are Teleostean Fishes of the order *Isospondyli* (or *Malacopterygii*); they are oceanic, some descending to considerable depths. They differ from the *Clupeoids* in possessing photophores, which are usually arranged in two series on each side of the lower part of the body. The dentigerous maxillary enters the gape and is firmly attached to the præmaxillary. The ribs are attached to short autogenous parapophyses which are inserted in pits

in the vertebral centra. The caudal fin skeleton is nearly as in the Clupeidæ, without upturned vertebræ.

A study of the osteology shows that the Stomiatoïds form two well-marked groups, of which the Gonostomatidæ and Astronesthidæ respectively are the most primitive families. The Gonostomatidæ are very near the Elopidae. Comparing *Photichthys* with *Elops** I find a striking agreement in the head-skeleton, the general form of the skull and the relations of the bones being almost exactly the same. In *Photichthys* the orbitosphenoid appears to be absent and the posterior temporal fossæ are somewhat smaller than in *Elops*, but there are no other differences of importance.

The skull of *Astronesthes* is much more specialized. There are no distinct subtemporal or posterior temporal fossæ, the frontals extend to the posterior end of the cranial roof, and the parietals are very small and separate. The præmaxillaries have anterior expansions which extend upwards over the mesethmoid, and the maxillary has no supramaxillaries (supplemental bones). The skeleton of *Astronesthes* shows many resemblances to that of the Cretaceous Eucodontidæ, a family that may belong to this group.

Synopsis of the Families.

- I. Præmaxillary without anterior expansion; maxillary with two supramaxillaries. Parietals meeting above supraoccipital. No barbel. Dorsal in advance or above anterior part of anal.

Body elongate. Skull elongate, with parasphenoid nearly straight. Epiotics separate; basisphenoid and alisphenoids present. Post-temporal forked; a mesocoracoid

1. *Gonostomatidæ*.

Body deep, strongly compressed. Skull short and deep, with parasphenoid bent at a right-angle. Epiotics meeting below supraoccipital; basisphenoid and alisphenoids absent. Post-temporal united with supracleithrum to form a rectangular bone, with short horizontal upper and long vertical lower limb; no mesocoracoid. Supraneurals projecting as a keel in front of dorsal fin

2. *Sternoptychiidæ*.

- II. Præmaxillary with strong anterior expansion extending upwards over ethmoid; maxillary slender, without supramaxillaries. Parietals very small and separate, or absent.

- A. Supracleithrum and mesocoracoid present; dorsal in advance of anal; an adipose fin; pectorals well developed.

* The head-skeleton of the Elopidae has been well described and illustrated by Ridewood (P. Z. S. 1904).

- Parietals present. A small plate-like post-temporal.
 First vertebra normal. Dorsal fin above or
 behind pelvics 3. *Astronesthidæ*.
- Parietals absent. No post-temporal. First vertebra
 very long. Dorsal fin well in advance of pelvics. 4. *Chauliodontidæ*.
- B. Parietals, post-temporal, supracleithrum, and mesocoracoid ab-
 sent. Dorsal and anal wholly or in great part opposed; no
 adipose fin; pectorals usually small or absent.
- Mouth wide; a hyoid barbel 5. *Stomiatidæ*.
- Mouth very wide; no barbel; mandibular sym-
 physis connected with hyoid by an elastic liga-
 ment; no integument between rami of lower
 jaw 6. *Malacosteidæ*.

Family 1. *Gonostomatidæ*.

I have examined skeletons of *Photichthys* (51 vertebræ), *Gonostoma* (39 vertebræ), and *Maurolicus* (34 vertebræ). Other important genera are *Cyclothone*, *Diplophos*, *Vinciguerria*, and *Ichthyococcus*. The last approaches the *Sternoptychiidæ* in the telescopic eyes, the narrow interorbital region, etc., but is essentially *Gonostomatid* in structure.

Family 2. *Sternoptychiidæ*.

I have examined the skeleton of *Argyropelecus* (36 vertebræ). The other genera are *Sternoptyx* and *Polyipnus*.

Family 3. *Astronesthidæ*.

I have studied the skeleton of *Astronesthes* (47 vertebræ). The other genera are *Borostomias* (with spaced maxillary teeth) and *Bathylchnis* (without hyoid barbel).

Family 4. *Chauliodontidæ*.

Chauliodus, the only genus of this family, is remarkable for its formidable dentition. In *C. sloanii* the vertebræ number 58; the neural arch of the enlarged first vertebra is represented by long paired laminae.

Family 5. *Stomiatidæ*.

I have examined the skeleton of *Stomias boa* (78 vertebræ). Most of the other genera (e. g., *Macrostomias*, *Echiostoma*, *Photonectes*, etc.) agree with *Stomias* in having the body moderately elongate, and the dorsal and anal fins opposed and nearly equal in length, but in *Eustomias* the anal is longer. *Idiacanthus* differs from the rest in being very elongate, with the tail long and slender and the dorsal fin longer than the anal.

Family 6. *Malacosteidæ*.

Three genera—*Malacosteus*, *Photostomias*, and *Thaumastomias*.